

## CLAIMS

1. A bonding apparatus for bonding objects to be bonded each having a metal bonding portion on a surface of a substrate, comprising:
  - a cleaning chamber;
  - cleaning means for irradiating energy waves to bonding surfaces of said metal bonding portions in said cleaning chamber under a reduced pressure condition;
  - bonding means for bonding said metal bonding portions of said objects to be bonded in an atmospheric air which have been taken out from said cleaning chamber;
  - and
  - carrying means for, with respect to at least one member of said objects to be bonded, carrying a foregoing object and an ensuing object substantially simultaneously in at least a carrying-in direction to said cleaning chamber and a carrying-out direction from said cleaning chamber.
2. The bonding apparatus according to claim 1, wherein said carrying means has a tray capable of placing thereon a plurality of objects to be bonded.
3. The bonding apparatus according to claim 2, wherein a carrying-in port and a carrying-out port for said tray of said cleaning chamber are constructed as a common port.
4. The bonding apparatus according to claim 2, wherein a carrying-in port and a carrying-out port for said tray of said cleaning chamber are constructed separately from each other.
5. The bonding apparatus according to claim 1, wherein said carrying means has a

carrying tape which holds a plurality of objects to be bonded arranged in a longitudinal direction of said carrying tape and which is fed intermittently at a predetermined feeding amount.

6. The bonding apparatus according to claim 5, wherein sealing means for sealing a portion of said carrying tape positioning in said cleaning chamber from outside of said cleaning chamber is provided to each of a carrying tape carrying-in portion to said cleaning chamber and a carrying tape carrying-out portion from said cleaning chamber.

7. The bonding apparatus according to claim 5, wherein a sag is given to said carrying tape at a position between said cleaning chamber and said bonding means.

8. The bonding apparatus according to claim 1, wherein said carrying means has means for performing together at least replacing for carrying in of an object to said cleaning chamber and replacing for carrying out of an object from said cleaning chamber one by one for said objects to be bonded.

9. The bonding apparatus according to claim 8, wherein said means for performing together has a rotary head with a plurality of object holding heads.

10. The bonding apparatus according to claim 1, wherein said cleaning chamber is constructed as a cleaning chamber common for both members of said objects to be bonded to each other.

11. The bonding apparatus according to claim 1, wherein said cleaning chamber is provided for each of both members of said objects to be bonded to each other.

12. The bonding apparatus according to claim 1, wherein a preparatory chamber for reducing pressure is attached to said cleaning chamber.
13. The bonding apparatus according to claim 1, wherein said cleaning means comprises means for irradiating plasma.
14. The bonding apparatus according to claim 13, wherein said cleaning means comprises an Ar plasma irradiating means.
15. The bonding apparatus according to claim 1, wherein said bonding means comprises a heating means.
16. The bonding apparatus according to claim 1, wherein said bonding means comprises a pressing means.
17. The bonding apparatus according to claim 1, wherein said bonding means comprises means for applying a ultrasonic wave.
18. The bonding apparatus according to claim 1, wherein said bonding means comprises an energy wave cleaning means for bonding for cleaning said bonding surfaces by energy waves at the time of bonding.
19. The bonding apparatus according to claim 1 further comprising means for supplying an inert gas or a non-oxidizing gas locally to cleaned bonding surfaces in at least one process of a carrying process of objects to be bonded, a holding process of

objects to be bonded for bonding, and an aligning process of objects to be bonded for bonding after cleaning in said cleaning chamber through bonding of said metal bonding portions to each other.

20. The bonding apparatus according to claim 1, wherein bonding surfaces of metal bonding portions of objects to be bonded to each other are both formed from gold.

21. The bonding apparatus according to claim 1, wherein said cleaning means is means for irradiating energy waves at an energy capable of etching said bonding surfaces over the entire sputtering surfaces at a depth of 1.6 nm or more.

22. The bonding apparatus according to claim 1, wherein said bonding means is means for making a dispersion of a gap between the metal bonding portions at the time of bonding to be 4  $\mu\text{m}$  or less at maximum.

23. The bonding apparatus according to claim 1, wherein a surface hardness of a metal bonding portion of at least one member of said objects to be bonded is set at 120 or less in Vickers hardness Hv.

24. A bonded material of objects bonded to each other each having a metal bonding portion on a surface of a substrate, made by a bonding apparatus comprising:

a cleaning chamber;

cleaning means for irradiating energy waves to bonding surfaces of said metal bonding portions in said cleaning chamber under a reduced pressure condition;

bonding means for bonding said metal bonding portions of said objects to be bonded in an atmospheric air which have been taken out from said cleaning chamber;

and

carrying means for, with respect to at least one member of said objects to be bonded, carrying a foregoing object and an ensuing object substantially simultaneously in at least a carrying-in direction to said cleaning chamber and a carrying-out direction from said cleaning chamber.

25. The bonded material according to claim 24, wherein at least one member of said objects bonded to each other comprises a semiconductor.